The Corps Process and Issues for Beach Nourishment Projects Construction and Renourishment Research and Development Needs

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Sand Borrow Sources

In the past ten years, there has been an increase in beach-fill construction projects by the Corps of Engineers. The New York District has had seven initial beach-fill contracts and six renourishment contracts in that time period. Each initial construction contract has been over a million cu yd of material, as have several of the renourishment contracts. The District is also presently formulating beach-fill projects that will need tens of millions of cu yd of sand to create design berms and dunes, advanced fill and feeder beaches. Because of the large quantities of beach-fill material needed, the identification of suitable borrow sources is of key importance to the New York District and the other coastal Districts of the Corps.

Recent discussions were held with East Coast Districts, Coastal and Hydraulics Laboratory staff, and Headquarters staff on the different methods to develop overfill estimates based on the variation of grain size and distribution between the native and the borrow material. The use of the standard methods (Ra and Rj) are being questioned and the use of new methods (equilibrium profile analyses) are being considered. In the interim, a combination of methods is being used. Research is needed to develop the most appropriate methods to be used to determine suitability of borrow material and overfill factors. Corps beach-fill project performance is dependent on finding and using appropriate sand borrow material.

Stone Construction

In conjunction with our beach-fill projects, the New York District has needed to modify groins for project design purposes. The Westhampton project required the shortening of two existing groins, and the reconstruction of their heads to achieve a tapered groin field. For Sea Bright to Manasquan project, 26 groins have been notched approximately between mean high water and –4.0 NGVD to aid the littoral transport of material. All of these efforts have been accomplished in the surf zone. The district has grappled with Quality Assurance/Quality Control issues during construction. A more efficient method of inspection for underwater stone construction needs to be developed to assure the proper placement of the stones in this dynamic location for optimum project performance.

Triggers for Renourishment

Beach-fill projects typically extend over miles of shoreline and encompass a range of littoral dynamics. The majority of most beach-fill project shoreline tends to be erosive, but unlike design

"average" erosion rates, real erosion rates are variable. Additionally, large projects will also typically include some accretive or stable reaches, and one or more highly erosive "hot spots". This variable response on the part of sandfill to weather and wave conditions can complicate the decision of exactly when and where to initiate a renourishment fill operation.

Some Factors in the Renourishment Decision

- Criteria used to measure performance (geometric/volumetric conditions/changes).
- Number, size and treatment of hot spots.
- Extent of past history available and confidence therein.
- Type of development and land usage – critical roads threatened, etc.
- Length of time required to prepare and execute renourishment P&S.
- Any need for modeling, monitoring, or further analysis.
- Local response (lack of local concern, great concern, local resources available for maintenance practices).
- Constructibility issues.
- Presence of other options such as available dredge material from a nearby inlet.

The New York District has used the factors listed above to make the renourishment decision for the Coney Island, the Sea Bright to Manasquan, and the Westhampton projects.

Coney Island, NY, has two very distinct reaches with differing erosion responses. The main project area, which experiences a low wave energy environment and has a history of fill operations at roughly 20-year intervals, and a much more dynamic downdrift area. Original design included renourishment at 10-year intervals for the entire filled shoreline.

Design criteria were used to evaluate fill performance in the main project area, where a geometrically defined fill cross-section was constructed. Following surveys each spring, the beach berm width and elevation were compared to the design cross-section. As of spring 2001, 5.5 years following initial construction, the fill remains beyond the design cross-section limits in the main project area. Consequently, the decision has been made each year not to renourish the main project area. The downdrift reach at Sea Gate, Coney Island, does not have a design cross-section. Renourishment decisions for this area are based on comparison to the pre-project condition. The criterion used in the Sea Gate area was to not allow shoreline conditions to become worse than preconstruction conditions.

Originally designed with a 6-year nourishment interval, the Sea Bright to Manasquan, NJ, project renourishment decision was complicated by a multi-year, multi-contract staggered initial construction. As with Coney Island, the design criteria used were comparison of the measured beach width and elevation to design cross-sectional width and elevation. This comparison was done at the time of monitoring surveys for all constructed reaches, regardless of the number of years since initial construction.

Performance was judged based on the percentage of shoreline that showed incursion into the design fill template. Renourishment of the first two construction reaches was delayed one year based on the profile analysis.

Westhampton, NY, again used the comparison of surveyed profiles with design template width and elevation as a criterion for renourishment. Volume changes were examined as well. The Westhampton project was designed with a 3-year renourishment interval. Initially constructed beginning in July of 1996 the first renourishment was done between November 2000 and February 2001. Performance again was adequate to delay renourishment by just over one year. The Westhampton design for renourishment consisted of a band of fill placed along the entire shoreline length. Due to variable shoreline response, some parts of the shoreline required only a very narrow band (i.e. less than 30 ft wide) of fill in order to be returned to a fully nourished cross-section. Placement of such a narrow band of fill has inherent constructibility difficulties. The renourishment fill volume was therefore adjusted alongshore to provide all the required fill volume in greater than 30 ft cross-sectional widths, with one unfilled reach in a portion of the updrift section of the project shoreline.

An objective, consistent method to "trigger" renourishment activities, while taking into account other decision factors, would lead to better estimates of renourishment cycles and quantities. The appropriate renourishment construction will maintain project function at the least cost and maximum value.

Hot Spot Predictions/Evaluations

To better estimate the performance of future beach-fill construction projects, the development of predictive tools and methods to identify and quantify possible "hot spot" locations during project formulation are needed.

Two existing hot spots were dealt with separately from the overall renourishment decision in the Sea Bright to Manasquan project, both in terms of analysis regarding causes of rapid sand movement, and for intermediate fill placements. Hot spot fill plus the volume placed in the first renourishment totals to more than the volume predicted as required under original design.